UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
2100 RENAISSANCE BOULEVARD, SUITE 100
KING OF PRUSSIA, PENNSYLVANIA 19406-2713

July 30, 2012

Mr. Michael J. Pacilio
Senior Vice President, Exelon Generation Company, LLC
President and Chief Nuclear Officer, Exelon Nuclear
4300 Winfield Rd.
Warrenville, IL 60555

SUBJECT: LIMERICK GENERATING STATION – NRC INSPECTION REPORT
05000352/2012009 AND 05000353/2012009

Dear Mr. Pacilio:

On June 21, 2012, the U.S. Nuclear Regulatory Commission (NRC) completed an inspection at your Limerick Generating Station, Units 1 and 2. The enclosed inspection report documents the inspection results, which were discussed on June 21, 2012 with Mr. F. Kearney, Site Vice President, and other members of your staff.

The inspection verified Exelon's license renewal program, including supporting activities, are planned or implemented consistent with the requirements of Title 10 of the Code of Federal Regulation Part 54, "Requirements for the Renewal of Operating Licenses for Nuclear Power Plants," and Exelon's license renewal application. For the aging management programs selected for review, the inspection verified Exelon has adequate programs planned, or in place, to implement aging management for the passive, long lived portions of systems, structures and components that are within the scope of renewal, such that they will be adequately maintained consistent with the rule.

In accordance with 10 CFR 2.390 of the NRCs "Rules of Practice," a copy of this letter, its enclosure, and your response (if any) will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records component of the NRC's document system (ADAMS). ADAMS is accessible from the NRC website at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

James M. Trapp, Chief
Engineering Branch 1
Division of Reactor Safety

Docket Nos. 50-352, 50-353
License Nos. NPF-39, NPF-85

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/RA/

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Engineering Branch 1
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Docket Nos. 50-352, 50-353
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NAME	MModes/JMT per tele	PKrohn/SMC	JTrapp		
DATE	7/30/12	7/27/12	7/30/12		

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Enclosure:
Inspection Report 05000352/2012009 and 05000353/2012009
w/Attachment: Supplemental Information

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SUMMARY OF FINDINGS

IR 05000352/2012009; 05000353/2012009; June 4 - 21, 2012; Limerick Generating Station, Units 1 and 2; License Renewal Inspection.

The inspection verified Exelon's license renewal program, including supporting activities, are planned or implemented consistent with the requirements of Title 10 of the Code of Federal Regulation Part 54, "Requirements for the Renewal of Operating Licenses for Nuclear Power Plants," and Exelon's license renewal application. For the aging management programs selected for review, the inspection verified Exelon has adequate programs planned, or in place, to implement aging management for the passive, long lived portions of systems, structures and components that are within the scope of renewal, such that they will be adequately maintained consistent with the rule.

U.S. NUCLEAR REGULATORY COMMISSION

REGION I

Docket Nos.:	50-352, 50-353
License Nos.:	NPF-39, NPF-85
Report No.:	05000352/2012009 and 05000353/2012009
Licensee:	Exelon Generation Company, LLC
Facility:	Limerick Generating Station, Units 1 & 2
Location:	Sanatoga, PA 19464
Dates:	June 4 -21, 2012
Inspectors:	M. Modes, Senior Reactor Inspector G. Meyer, Senior Reactor Inspector J. Richmond, Senior Reactor Inspector J. Lilliendahl, Reactor Inspector S. Chaudhary, Reactor Inspector J. Klos, Technical Reviewer NRR
Approved By:	James M. Trapp, Chief Engineering Branch 1 Division of Reactor Safety

Enclosure

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REPORT DETAILS

4. OTHER ACTIVITIES

4OA5 Other Activities (71002)

.1 License Renewal Inspections

a. Inspection Scope

This inspection verifies the applicant's license renewal program, including supporting activities, are planned or implemented consistent with the requirements of Title 10 of the Code of Federal Regulation Part 54, "Requirements for the Renewal of Operating Licenses for Nuclear Power Plants," and the applicant's license renewal application. This inspection verifies the applicant has adequate programs planned or in place to implement aging management for the passive, long lived portions of systems, structures and components that require an aging management review, such that these systems, structures and components will be adequately maintained consistent with the rule, the staff's existing safety evaluations, and the applicant's license renewal program. This inspection also verifies the information and documentation required by or necessary to document compliance with the provisions of the rule are retrievable, auditable and consistent with the rule and applicant approved programs and procedures.

Scoping of Non-Safety Related Structures, Systems, and Components

The inspectors reviewed the applicant's program guidance procedures and summaries of scoping results for the facility to assess the thoroughness and accuracy of the methods used to bring structures, systems, and components within the scope of the License Renewal Application. Further, the team assessed the applicant's activities related to scoping non-safety related structures, systems, and components, as required in 10 CFR 54.4(a)(2). The team verified the applicant established procedures consistent with the NRC endorsed guidance contained in Nuclear Energy Institute (NEI) 95-10, "Industry Guideline for Implementing the Requirements of 10 CFR Part 54 – The License Renewal Rule," Revision 6, Appendix F, Sections 3, 4, and 5. Specifically, the inspectors reviewed the manner in which the applicant evaluated: (1) non-safety related structures, systems, and components within the scope of the current licensing basis, (2) non-safety related structures, systems, and components directly connected to safety related structures, systems, and components, and (3) non-safety related structures, systems, and components not directly connected but spatially near to safety-related structures, systems, and components, respectively.

The inspectors reviewed the complete set of license renewal drawings, which had been color coded to indicate systems and components in-scope for 10 CFR 54.4(a)(1), (a)(2) and (a)(3). The team interviewed personnel, reviewed program documents and independently walked down areas within the plant, including the Units 1 and 2 Reactor Enclosures, Units 1 and 2 Turbine Enclosures, Essential Service Water pipe tunnel, and 2A Emergency Diesel Generator Room.

For structures, systems, and components determined to be within license renewal scope because of potential spatial interactions, where failure of non-safety related components could adversely affect adjacent safety-related components, the inspectors determined that the applicant had categorized the structures, systems, and components in a generally sound, thorough, and accurate manner. The inspectors identified one isolated instance of an incorrect determination of a Unit 2 component, a drain valve for the spent resin discharge header located in the Unit 1 Turbine Building, which had not been appropriately included within scope. The applicant reviewed the circumstances of the error, concluded that the error was isolated, and revised the license renewal drawing.

For structures, systems, and components included within license renewal scope because of potential structural interaction (seismic design of safety-related components dependent upon non-safety related components), the inspectors determined that the applicant accurately identified and categorized the structural boundaries within the program documents. The inspectors reviewed the seismic anchor books, which provided the detailed basis for each seismic boundary point, and independently sampled seismic boundaries, including review of the isometric drawings and in-plant verification of the seismic boundary determinations.

The inspectors reviewed the complete set of license renewal drawings (Revision 1 – see attachment), which were addressed in Exelon letter, Response to NRC Request for Additional Information dated February 23, March 9, and March 20, 2012. NRC letter Request for Additional Information, dated May 18, 2012, addressed scoping changes noted on Revision 1 of the drawings. The inspectors reviewed license renewal drawings to verify that the scoping changes had been appropriately included.

Operating Experience

The inspectors reviewed the Exelon response to the NRC request for additional information (RAI) B.1.4-1, and RAI A.1-1. In this response, Exelon addressed specific requests (a) through (n) describing such things as the sources of plant specific experience referenced and categorization of operating experience for aging management guidance documents. The inspector compared these responses to the proposed revisions to Exelon LS-AA-115, Operating Experience Program, Revision 17, LS-AA-115, Processing of Level 3 OPEX Evaluations, Revision 2, LS-AA-115-1004, Processing of NERs, NNOE's and Root Cause Report Transmittals to INPO, Revision 2, ER-AA-700-1001, Aging Management Program Site Implementation Guideline, Revision 2, and LS-AA-120, Issue Identification and Screen Process, Revision 14. The inspector reviewed the documents to determine the rigor of the program, how this information was distributed, and how the program would address the requirements of aging management.

The inspectors noted operational experience is segregated for aging affects and sent to aging management program owners directly. The direction to the owner is to use adverse aging related operating experience to improve the program.

Aging Management Programs

B.2.1.4 BWR Vessel ID Attachment Welds

This program manages the aging effect of stress corrosion cracking and intergranular stress corrosion cracking in attachments to the inside diameter of the reactor vessel. These attachments include the steam dryer support and hold down bracket attachment welds, guide rod bracket attachment welds, feedwater sparger bracket attachment welds, jet pump riser brace attachment welds, core spray piping bracket attachment welds, and surveillance sample holder bracket attachment welds. The program uses the inspection and flaw evaluation criteria in BWRVIP-48-A. In addition to reviewing work orders, operating experience, engineering reports, inspection summary reports, the inspector reviewed inspection reports for the core spray piping hold down brackets, and pins. The reports contained photographic records of the areas inspected with indications of wear on the bracket-to-holder noted. The inspector compared the examinations and analysis against the inspection guidance.

The BWR Vessel ID Attachment Welds aging management program provides for periodic examination of welds in accordance with the Inservice Inspection program, per ASME Section XI, Subsection IWB, Table IWB-2500-1, Examination Categories B-N-1 and B-N-2, and staff-approved BWRVIP-48-A, "Vessel ID Attachment Weld Inspection and Evaluation Guidelines." The current ISI Program plan for the third ten-year inspection interval is based on the 2001 ASME Section XI B&PV Code, including 2003 addenda, and includes approved relief request 13R-03 that allows examination methods and frequency per BWRVIP-48-A in lieu of Table IWB-2500-1.

The scope of the inspection activities includes the steam dryer support and hold down bracket attachment welds, guide rod bracket attachment welds, feedwater sparger bracket attachment welds, jet pump riser brace attachment welds, core spray piping bracket attachment welds, and surveillance sample holder bracket attachment welds. Only the jet pump riser brace attachment welds and lower surveillance sample holder attachment welds are within the reactor pressure vessel beltline region and exposed to neutron flux. The inspections monitor for cracking of all the attachment welds and loss of material due to wear of the steam dryer support brackets.

The BWR Vessel ID Attachment Weld program implements ASME Section XI inspection requirements through the Inservice Inspection program plan. Because the staff-approved examination requirements within BWRVIP-48-A generally meet or exceed the requirements of Table IWB 2500-1, relief request 13R-03 is in place to implement BWRVIP-48-A examination methods and frequency requirements. The specific inspection activities include:

- Jet pump riser brace attachment welds are examined per the frequency and methods of BWRVIP-48-A. All received baseline inspections and 25% are examined each subsequent 6-year period using EVT-1 methods.
- Core spray piping bracket attachment welds are examined per the frequency and methods of BWRVIP-48-A. All received baseline inspections and 100% are inspected every 4 refueling cycles using EVT-1 methods.

- The feedwater sparger bracket and steam dryer support and hold down bracket attachment welds are examined using EVT-1 methods per BWRVIP-48-A, at the frequency per ASME Section XI, Examination Category for B-N-2 components of once per 10-year interval.
- The surveillance sample holder bracket attachment welds are examined once per 10-year interval per BWRVIP-48-A and ASME Section XI, Table IWB 2500-1. VT-1 method is used for the lower surveillance sample holder attachment welds that are within the RPV beltline region, and VT-3 method is used for the upper surveillance holder attachment welds.
- The guide rod bracket attachment welds are examined per the frequency and methods of BWRVIP-48-A and ASME Section XI, Table IWB 2500-1, using VT-3 methods once per 10-year interval.
- Repair and replacement activities, if needed, are performed in accordance with the recommendations of the appropriate BWRVIP repair/replacement guidelines and the requirements of ASME Section XI.

The inspectors reviewed implementing procedures, records of results, and interviewed responsible program managers.

B.2.1.5 BWR Feedwater Nozzle

As recommended by NUREG-0619, "BWR Feedwater Nozzle and Control Rod Drive Return Line Nozzle Cracking", November 13, 1980, the feedwater thermal fatigue cracking of the inner radius of the nozzle has been mitigated by

1. not cladding the inner radius surface of the nozzle,
2. using a triple thermal sleeve feedwater sparger design with two ring seals,
3. by utilizing low flow feedwater control, and
4. by reactor water clean-up routed to return warm water to the feedwater flow.

In addition, the applicant implements the inspection regime of the Boiling Water Reactor Owners Group report GE-NE-523-A71-0594-A, Revision 1, Alternate BWR Feedwater Nozzle Inspection Requirements, dated August 1999. The alternate inspection requires the ultrasonic examination of nozzle zones 1, 2, and 3 every 10 years with no inspection required for zone 4. The BWR Feedwater Nozzle aging management program provides for periodic examination of the RPV feedwater nozzles. The program monitors the effects of cracking due to cyclic loading by detection and sizing of cracks using the examination methodology and frequency recommendations of GE-NE-523-A71-0594-A, Revision 1, and the examination requirements of ASME Section XI, Subsection IWB, Table IWB-2500-1. The inspectors reviewed a sample of examinations to verify the tests were calibrated and performed in conformance with the guidance.

B.2.1.6 BWR Control Rod Drive Return Line Nozzle

Prior to operation, Limerick cut and capped these lines to avoid the turbulent mixing of hot water in the vessel with the lower temperature water returning from the Control Rod Drives which caused high frequency thermal fatigue cycling during normal operation in

earlier BWR reactor vessels. As a consequence, the nozzles became a stagnant dead-end subject to intergranular stress corrosion cracking requiring augmented inspections as part of commitments made in response to Generic Letter 88-01 which became BWR Vessels Internal Project Program 75-A. For this reason, the Control Rod Drive return line nozzles are inspected, per ER-LG-330-1002, Augmented Inspection Program Number, AUG-02.

The program requires periodic Ultrasonic examination of specific regions of the Control Rod Drive return line nozzle, including the nozzle to vessel weld, nozzle to cap weld, and nozzle blend radius in accordance with the requirements of ASME Section XI, Subsection IWB, Table IWB-2500-1. The nozzle blend radius and nozzle to vessel weld are inspected at the frequency specified by ASME Section XI, Subsection IWB. The nozzle to cap weld is inspected at a frequency specified by the augmented Inservice Inspection Stress Corrosion Cracking program that implements the requirements of NRC Generic Letter 88-01 and BWRVIP-75-A. The program is enhanced to extend the volume of inspection to one pipe wall thickness distance on either side of the weld to base metal interface.

The inspectors reviewed implementing procedures, records of results, and interviewed responsible program managers.

B.2.1.7 BWR Stress Corrosion Cracking

The BWR Stress Corrosion Cracking aging management program is a periodic inspection program of stainless and nickel based alloy piping, safe ends, and associated welds that are 4 inches or larger nominal pipe size and contain reactor coolant at greater than 200 degrees Fahrenheit that are susceptible to intergranular stress corrosion cracking. The program follows the guidance contained in NUREG-0313, Revision 2 and NRC GL 88-01 with Supplement 1 as modified by BWRVIP-75-A. The program includes the use of intergranular stress corrosion cracking resistant materials, controlling reactor coolant water chemistry, and mitigation measures to such as Mechanical Stress Improvement on welds. The inspection program is performed as an augmented program within the ASME Section XI ISI program.

The inspectors reviewed implementing procedures, records of results, and interviewed responsible program managers.

B.2.1.8 BWR Penetrations

The BWR Penetration aging management program provides for periodic examination of reactor vessel penetration welds in accordance with ASME Section XI, Subsection IWB, Table IWB-2500-1, BWRVIP-49-A (instrumentation penetrations), and BWRVIP-47-A (control rod drive and incore-monitoring housing penetrations). The program also credits the Water Chemistry aging management program.

The inspection includes the following penetrations:

- Instrumentation nozzles N11, N12 and N16,
- Incore Monitor housing penetrations in the bottom head, and
- Control Rod Drive housing penetrations in the bottom head

The reactor vessel penetrations for instrumentation, control rod drive, and incore monitoring housings are inspected for cracking as part of the Reactor Vessel and Internals program. The Reactor Vessel and Internals program is in accordance with ASME Section XI, Subsection IWB, Table IWB-2500-1, which is consistent with the guidance in BWRVIP-49-A and BWRVIP-47-A.

The inspectors reviewed implementing procedures, records of results, and interviewed responsible program managers.

B.2.1.9 BWR Vessel Internals

The BWR Vessel Internals aging management program provides for periodic examinations of the reactor vessel and internal components in conformance with guidelines within the latest revision of Boiling Water Reactor Vessel and Internals Project reports. These activities include inspections, and monitoring and trending of results to confirm that aging effects are managed.

In addition, the program credits monitoring and control of reactor coolant water chemistry in accordance with the Water Chemistry aging management program.
The program scope includes examination of the following reactor internal components in accordance with the guidelines in the following referenced BWRVIP reports. Also referenced are the BWRVIP reports that define the required repair design criteria.

- Core Shroud - BWRVIP-76-A, BWRVIP-02-A
- Core Plate - BWRVIP-25, BWRVIP-50-A
- Core Spray - BWRVIP-18 Revision 1, BWRVIP-16-A and BWRVIP-19-A
- Shroud Support - BWRVIP-38, BWRVIP-52-A
- Jet Pump Assembly - BWRVIP-41 Revision 2, BWRVIP-51-A
- LPCI Coupling - BWRVIP-42 Revision 1, BWRVIP-56-A
- Top Guide - BWRVIP-26-A and BWRVIP-183, BWRVIP-50-A
- CRD Housings - BWRVIP-47-A, BWRVIP-55-A and BWRVIP-58-A
- Lower Plenum Components - BWRVIP-47-A, BWRVIP-55-A
- Steam Dryer - BWRVIP-139-A, BWRVIP-181-A

The program will be enhanced prior to the period of extended operation to:

1. Perform an assessment of the susceptibility of reactor vessel internal components fabricated from cast alloy stainless steel to loss of fracture toughness due to thermal aging embrittlement. If material properties cannot be determined, they will be assumed susceptible for the purposes of determining program examination requirements.

2. Perform an assessment of the susceptibility of reactor vessel internal components fabricated from cast alloy stainless steel to loss of fracture toughness due to neutron irradiation embrittlement.
3. Specify the required periodic inspection of cast alloy stainless steel components determined to be susceptible to loss of fracture toughness.

The initial inspections will be performed either prior to or within 5 years after entering the period of extended operation. The inspectors reviewed implementing procedures, records of results, and interviewed responsible program managers.

B.2.1.10 Flow-Accelerated Corrosion

The Flow-Accelerated Corrosion program is an existing program based on the Electric Power Research Institute guidelines in the Nuclear Safety Analysis Center Report NSAC-202L-R3 that predicts, detects, and monitors wall thinning in piping and components due to flow-accelerated corrosion. The Flow-Accelerated Corrosion program provides for prediction of the amount of wall thinning through analytical evaluations and periodic examinations of locations most susceptible to Flow-Accelerated Corrosion induced loss of material.

The inspectors reviewed inspection results of the existing program and noted the applicant's identification of revisions to the implementing procedures necessary to bring the programs into conformance with the NRC standards for an aging management program.

B.2.1.12 Open-Cycle Cooling Water System

The Open-Cycle Cooling Water System Program is an existing program, with enhancements, that manages piping components and heat exchangers exposed to raw water for loss of material, reduction of heat transfer, and loss of elastomeric properties through tests, visual inspections, non-destructive examinations, and cleaning activities while consistent with the Exelon commitments for Generic Letter 89-13, "Service Water Problems Affecting Safety-Related Components." Additionally, the program includes chemical and biocide injections and performs periodic inspections for the presence of biofouling. The program also states that heat transfer capabilities are verified through periodic heat transfer testing, or inspection and cleaning of heat exchangers, and that polymeric materials included in this program are examined consistent with the Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components Program.

The program will be enhanced by:

- performing inspections of the internal surfaces of buried safety-related service water piping when accessible during maintenance and repair activities, and by reviewing the results of the residual heat removal service water piping which is similar process piping,
- performing periodic inspections of non safety-related service water piping for loss of material at a frequency of once every refueling outage at a minimum of five locations on each unit with locations selected based on susceptibility to aging

effects to ensure that loss of material will be detected prior to loss of intended function,
- replacement of the supply and return piping for the core spray pump compartment unit coolers, and
- performing periodic inspections of the degraded residual heat removal service water piping in the piping tunnel.

The Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment," program is regularly reviewed by the NRC during the inspection IP71111.07 "Heat Sink Inspection." During a Region I inspection completed on December 31, 2011, the Residual Heat Removal room unit cooler was chosen as a sample and the inspectors reviewed the design basis for the component. The inspectors did not identify any findings during the inspection.

The inspectors reviewed basis documents, in order to understand the applicant's program, scope, and two recent enhancements added to the program based on aging management program audit RAI B2.1.12-1 and RAI B2.1.12-2. The inspectors also confirmed that the maintenance, operating and training practices and procedures were consistent with the intent of GL 89-13. The inspectors conducted interviews, to determine what the scoping basis was for portions of non safety-related components added to the scope of the program. The discussions identified that the applicant had appropriately included non safety-related components into the program. The inspectors reviewed maintenance procedures to verify appropriate component scope and the frequency of inspections. This review confirmed that the components selected and the frequencies applied were based on the applicant's response to NRC GL 89-13 and system trending.

The inspectors conducted a walkdown of the Unit 1/2 common spray pond structure and associated equipment. The inspectors observed the conditions outside and inside the spray pond pump house and the associated piping and pumps of the essential service water and the residual heat removal service water systems.

The inspectors reviewed the operating experience program to confirm that historical events related to aging effects were included in plant programs. The operational experience review found that the applicant had properly applied historical information into the programs and had identified program enhancements.

The team concluded that with the planned enhancements to the program, the applicant had provided guidance to appropriately indentify and address aging effects during the period of extended operation.

B.2.1.13 Closed Treated Water Systems

The Closed Treated Water Systems program is an existing program, with enhancements, that manages loss of material and reduction of heat transfer in piping, piping components, piping elements, tanks, and heat exchangers exposed to a closed treated water environment. The program also includes nitrate-based water treatment to modify the water's chemical composition so that corrosion effects are minimized, and chemical testing of the water to ensure that the water chemistry remains within acceptable guidelines.

The program will be enhanced by:

- including activities for condition and performance monitoring, and periodic testing and nondestructive examination (NDE) to verify the effectiveness of the water chemistry at mitigating aging effects at an interval not to exceed once in 10 years during the period of extended operation, and
- condition monitoring the 2A Reactor Water Cleanup System non-regenerative heat exchanger for loss of material due to cavitation erosion, with an initial inspection frequency of 4 years and future frequency adjustments based on trend data.

The inspectors reviewed:

- basis documents, in order to understand the applicant's program, scope and enhancements. The document did identify the program, in full, including its enhancements.
- implementation procedures, to verify the program includes chemical testing and its frequency to ensure that water chemistry are within acceptable guidelines. The document did state the chemical testing for the program and its frequency.
- chemistry procedures, to verify that the program does treat and monitor for microbiological growth of aerobic, anaerobic and sulfate reducing bacteria. The documents were reviewed and verified that the program's treatment and monitoring methods were applied to the program's procedures. The chemistry procedures were also reviewed to verify that when Level 1 and Level 2 action levels are entered that increased sampling frequencies occur until parameters returned to normal consistent with Electric Power Research Institute (EPRI) guidelines. The documents did verify that increased sampling frequencies, consistent with EPRI guidelines, are part of the program procedures.
- related sections of the license renewal application, to verify that the managed scope of aging effects described in the applicant's program is reflected in the aging management review lines. The license renewal application sections did reflect the appropriate scope of aging effects to be managed by the program.
- operating experience, to consider the condition of the plant and whether historical events presented aging effects that should be applied to, or created adjustments in the current/future program. The operational experience revealed that the applicant properly applied the program based on this historical data and the intended enhancements for the program.

- plant procedures to verify that the program enhancement's associated performance, condition monitoring, and periodic nondestructive testing and periodic testing were part of the plant procedural process. The documents indicated that the inspections and frequencies associated with the program's enhancements were part of the program's plant procedures.
- EPRI guidelines to verify that industry standards for pH control were met by the program's chemistry plan as documented in the program basis document. The guidelines for pH range limits were noted to be more conservative than the EPRI guidelines.

The inspectors also conducted interviews, to gain historical insight into the status and condition of the plant and assess the plant personnel's understanding and intended application of the program. The discussions revealed that the applicant was familiar with the program and its application.

B.2.1.15 Compressed Air Monitoring Program

The Compressed Air Monitoring Program is an existing program at Limerick, which manages the aging of components in the compressed air systems for loss of material in air and gas systems. The program is based on the Limerick responses to NRC Generic Letter 88-14, "Instrument Air System Problems," and includes activities, such as inspection of receivers and tanks, and air quality checks at various locations in the compressed air systems to ensure that dew point, particulates, and contaminants are maintained within specified limits.

The inspectors reviewed the program basis document, discussed program activities with responsible license renewal and system engineering personnel, and reviewed operating experience, implementing inspection and test procedures, and alarm response procedures. The inspectors conducted walk-downs to assess in-plant air system conditions for the Units 1 and 2 instrument and service air compressors, Unit 2 primary containment instrument gas compressor, and back-up service air compressor.

B.2.1.17 Fire Protection Program

The Fire Protection aging management program is an existing program that will be enhanced prior to the period of extended operation. The program is credited with managing the aging effects in fire barrier systems, and the Halon and carbon dioxide fire suppression systems. The aging effects will be managed by periodic inspection of fire barrier penetration seals; fire barrier walls, ceilings, and floors; fire-rated dampers; and periodic inspection and functional tests of fire-rated doors to ensure that their operability is maintained. The program will also include periodic inspection and testing of the Halon and carbon dioxide fire suppression systems.

The inspectors reviewed the existing fire protection program, approved station procedures and supporting documents, application sections A.2.1.17 and B.2.1.17, fire protection system aging management review results, and the program basis document to evaluate the effectiveness of the existing program, with proposed enhancements, to

manage the effects of the identified aging mechanisms. The inspectors reviewed applicant responses to requests for additional information. Surveillance procedures were reviewed for completeness and compliance with applicable regulatory requirements and National Fire Protection Association standards. In addition, the proposed program enhancements were reviewed for adequacy and completeness. The inspectors also interviewed station personnel associated with the fire protection program.

The inspectors identified an inconsistency between (a) the description of fire-rated damper inspection and testing in Exelon's application and (b) current station procedures. Exelon's application stated that a 10% sample of fire dampers shall be functionally tested at least once per 24 months. Within the last year, Limerick surveillance procedures had been revised to only require damper functional testing when a damper failed a visual inspection. The inspectors noted that the Limerick Technical Requirements Manual only required visual inspection of fire dampers, and NUREG-1801, Rev. 2, XI.M26, "Fire Protection Program," also only recommended visual inspection. The inspectors reviewed Exelon's technical basis for the elimination of damper functional testing and determined that it contained two unevaluated assumptions. The assumptions were:

1. Exelon assumed that a lack of industry operating experience for fire-rated damper failures meant that dampers always worked (e.g., a very low failure rate), as opposed to no large fires had occurred that would have resulted in a damper actuation (i.e., no event based opportunity to identify damper failure rates).

2. Exelon also assumed that when dampers which were routinely mechanically exercised (i.e., a damper drop test) exhibited a very low failure rate, that the same very low failure rate would be exhibited by dampers which were never mechanically exercised.

Exelon issued corrective action issue report IR 01380253 to re-evaluate the technical basis for not functionally testing fire dampers.

The inspectors verified that Exelon had performed adequate historic reviews of plant specific and industry experience to determine aging effects. The inspectors noted that there were no exceptions to the recommendations of NUREG-1801, Rev. 2, XI.M26, "Fire Protection Program."

B.2.1.19 Aboveground Metallic Tanks

The Aboveground Metallic Tanks aging management program, an existing program, will be enhanced for management of loss of material. This program is a condition monitoring program and credits the application of paint as a corrosion preventive measure. The only tank in the program scope is the Backup Water Storage Tank, 10-T402. This tank is covered with a spray-on polyurethane foam insulation that adheres to the tank painted surface. The tank is supported by a compacted oil treated sand bed. The inspectors reviewed Exelon's recurring order PM384104 to visually inspect the tank external

insulation/coating to monitor for degradation of the insulation and coatings on the tank external surfaces.

The inspectors noted the Aboveground Metallic Tanks aging management program will be enhanced to:

1. Include ultrasonic testing (UT) measurements of the bottom of the Backup Water Storage Tank. Tank bottom UT inspections will be performed within five years prior to entering the period of extended operation and every five years thereafter. If no tank bottom plate material loss is identified after the first two inspections, the remaining inspections will be performed whenever the tank is drained during the period of extended operation.

2. Provide visual inspections of the Backup Water Storage Tank external surfaces and include, on a sampling basis, removal of insulation to permit inspection of the tank surface. An inspection performed prior to entering the period of extended operation will include a minimum of 25 locations to demonstrate that the tank painted surface is not degraded under the insulation. Subsequent tank external surface visual inspections will be conducted on a two-year frequency and include a minimum of four locations.

B.2.1.20 Fuel Oil Chemistry Program

The Fuel Oil Chemistry Program is an existing program at Limerick, which manages the aging effects due to general, pitting, crevice, and microbiological influenced corrosion on internal surfaces of the diesel fuel oil system piping, piping components, and tanks by minimizing exposure to fuel oil contaminated with water and microbes.

The inspectors reviewed the program basis document, applicable program and implementing procedures, operating experience, and system reports. The inspectors interviewed license renewal personnel and inspected in-plant conditions of the 2A emergency diesel generator and diesel-driven fire pump, and associated fuel oil piping, tanks, and components.

B.2.1.21 Reactor Vessel Surveillance

The Exelon Reactor Vessel Surveillance program, at Limerick Generating Station, is an existing program that manages loss of fracture toughness due to neutron irradiation embrittlement of the reactor pressure vessel beltline materials. The program manages these aging effects using a combination of neutron embrittlement analyses, limiting the pressure and temperature below an analyzed limit, and monitoring neutron fluence.

Three surveillance capsules were initially installed in the Limerick Unit 1 reactor. The capsules were attached radially to the inside surface of the reactor pressure vessel, looking outward from the core region, at the 30, 120, and 300 degree azimuths. The inspectors noted that no capsules have been removed from the vessel.

The inspectors reviewed the implementation of ER-AB-331-1003, Attachment 1 and Attachment 2 for the calculation of the adjusted reference temperature. The inspectors reviewed the Unit 1 and 2 updated data in IR 810576-03 to determine the current limiting conditions and if the latest BWRVIP-135 data had been accounted for. The results showed that Unit 1 and Unit 2 is plate limited for toughness.

The inspectors noted the current pressure-temperature curves, calculated in conformance with 10 CFR Part 50, are valid for fluence values equivalent to 32 Effective Full Power Years (EFPY). This will require updating the pressure-temperature limit curves and submittal of a License Amendment Request to revise Technical Specifications at least one year prior to exceeding 32 EFPY. For License Renewal, new fluence projections were developed for 57 EFPY that are bounding for 60 years of operation and meet the requirements of Regulatory Guide 1.190. The fluence monitoring will continue through the period of extended operation to ensure the cumulative fluence will not exceed the fluence value associated with 57 EFPY of operation.

B.2.1.22 One Time Inspection Program

The One-Time Inspection Program is a new aging management program at Limerick which is to address the effectiveness of the existing Water Chemistry, Fuel Oil Chemistry, and Lubricating Oil Analysis Programs in managing the aging of plant systems. The planned visual and volumetric inspections are to provide direct evidence of the presence and extent of loss of material resulting from all types of corrosion in treated liquid environments if it has occurred. The inspection also provides direct evidence of any cracking as a result of stress corrosion cracking.

The inspectors reviewed the program and sample basis documents, and plant operating experience, and discussed the program and planned activities with the license renewal staff. The inspectors noted that the applicant provided a preliminary sampling plan which met the objectives of the sampling plan specified in Revision 2 to the Generic Aging Lessons Learned Report (GALL), Section XI.M32. The team confirmed that appropriately qualified personnel will perform the nondestructive evaluations by using procedures and processes consistent with the regulatory requirements.

B.2.1.23 Selective Leaching Program

The Selective Leaching Program is a new aging management program at Limerick to detect the aging of components made of gray cast iron, bronze, brass, and other alloys exposed to raw water, treated water, soil, or other environments that may lead to selective leaching. The program will include visual inspections and mechanical testing of a sample of components with metallurgical properties susceptible to selective leaching to determine whether loss of material had occurred. Further, the program evaluates whether selective leaching, if it had occurred, would affect the ability of the components to perform the intended function during the period of extended operation.

The inspectors reviewed the program and sampling basis documents, plant operating experience, including a database of failure analyses, and a draft program procedure. The team discussed the program and planned activities with the license renewal staff,

who noted that there were no aluminum bronze components at Limerick and no evidence of selective leaching.

B.2.1.24 One-Time Inspection of ASME Code Class 1 Small-Bore Piping

The One-Time Inspection of ASME Code Class 1 Small-Bore Piping aging management program is a new program that provides for performing volumetric examinations of selected small-bore butt welds and socket welds in ASME Code Class 1 piping that is greater or equal to than nominal pipe size (NPS) 1 and less than NPS 4.

To date, Limerick Generating Station has not experienced cracking of small bore piping as a result of intergranular stress corrosion cracking, thermal fatigue, mechanical fatigue or vibration fatigue. Because Limerick Generating Station Units 1 and 2 have only operated for 25 and 21 years, respectively, at the time of the license renewal application submittal, a follow-up review of Limerick Generating Station related operating experience is required after at least 30 years of operation. The inspections that may result as a consequence of this review are required to be performed within the 6-year period prior to entering the period of extended operation.

Consistent with NUREG-1801, Limerick Generating Station is required to examine 8 butt welds on Unit 1, 9 butt welds on Unit 2, and 25 socket welds from each unit be selected for one-time inspection. If the follow-up operational experience review concludes that neither Limerick unit experienced cracking of small-bore Class 1 piping caused by intergranular stress corrosion cracking or cyclical (including thermal, mechanical and vibratory) fatigue, then a commitment change may be implemented to reduce the required number of inspections. NUREG-1801, Revision 2 guidance, stipulates that for plants with greater than 30 years of operation with no cracking in Class 1 small-bore piping, the sample size can be 3% or a maximum of 10 welds of each weld type. This would result in a reduction to 3 butt welds and 10 socket welds from each unit selected for one-time inspection.

B.2.1.26 Internal Surfaces in Miscellaneous Piping and Ducting Components

The Internal Surfaces in Miscellaneous Piping and Ducting Components (Internal Surfaces) aging management program is a new program that will inspect the internals of piping, piping components, ducting, and other components of various materials to manage the aging effects of cracking, loss of material, reduction of heat transfer, and hardening and loss of strength of elastomers. The program inspections will be inspections-of-opportunity that will occur during maintenance and surveillance activities when systems are opened.

The inspectors reviewed application sections A.2.1.26 and B.2.1.26, aging management review results, and the program basis document to evaluate the effectiveness of the proposed program to manage the effects of the identified aging mechanisms. The inspectors also reviewed applicant responses to requests for additional information, and

a draft implementing procedure. In addition, the inspectors interviewed Exelon personnel associated with the development of the draft implementing procedure.

The inspectors verified that Exelon had performed adequate historic reviews of plant specific and industry experience to determine aging effects. The inspectors noted that there were no exceptions to the recommendations of NUREG-1801, Rev. 2, XI.M38, "Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components."

The inspectors concluded Exelon had performed adequate evaluations, including reviews of industry experience and plant history, to determine aging effects. In draft program level documents, Exelon provided adequate guidance to ensure aging effects will be appropriately identified and addressed.

B.2.1.28 Monitoring of Neutron-Absorbing Materials Other than Boraflex

The Monitoring of Neutron-Absorbing Materials Other Than Boraflex program is an existing condition monitoring program that periodically analyzes test coupons of the boral material in the Unit 1 and Unit 2 spent fuel storage racks to determine if the neutron-absorbing capability of the material has degraded. This program ensures that a 5 percent sub-criticality margin is maintained in the spent fuel pool.

The Monitoring of Neutron Absorbing Materials Other Than Boraflex aging management program manages the effects of aging on the boral neutron-absorbing material used in the spent fuel storage racks. The Monitoring of Neutron Absorbing Materials Other Than Boraflex program monitors the physical condition of the boral material in the spent fuel storage racks by analysis of test coupons for physical attributes, neutron attenuation testing, dimensional checks, and weight and density characteristics. The primary measurements for characterizing the performance of the boral are the coupon thickness measurements (to characterize any bulging or swelling) and neutron attenuation tests (to confirm the continued presence of Boron-10). The other tests provide supporting information to assure that there are no previously unrecognized mechanisms for degradation and to reveal any possible long-term synergistic effects.

Test coupon analysis will be performed on a 10-year frequency, beginning no earlier than 2020 for Unit 1 and 2021 for Unit 2. This will be an enhancement to the existing program, since currently there is no required frequency. The program will also be enhanced to require that corrective actions be initiated if coupon test results indicate that sub-criticality margin would not be maintained given projected future degradation. The program presently only requires corrective actions if the sub-criticality margin is not maintained in the current condition. Other enhancements to the program will be implemented to ensure that the exposure of the coupons bounds that of the most limiting location of a spent fuel storage rack cell, and are: resuming an accelerated exposure configuration (surrounded by freshly discharged fuel) at each of five additional refueling cycles beginning with the next refueling for each unit, and maintaining the coupon exposure such that it is bounding by relocating the coupon tree to a different spent fuel rack cell location each cycle and by surrounding it with a greater number of freshly discharged fuel assemblies than that of any other cell location.

The acceptance criteria are for neutron attenuation results to show that a decrease of no more than 5% of Boron-10 content has occurred, and that dimensional measurements show that an increase in thickness at any point does not exceed 10% of the initial thickness at that point.

B.2.1.29 Buried and Underground Piping and Tanks Program

The Buried and Underground Piping and Tanks Program is an existing program at Limerick, which manages the aging effect of loss of material on the external surfaces of buried and underground piping and tanks composed of metallic materials. Because of preventive and mitigating techniques, such as external coatings, cathodic protection, and cementitious, flowable backfill, direct inspections of buried piping in contact with soil are not required by Revision 2 to the GALL Report, Section XI.M41. Other inspection activities, such as non-destructive evaluation of piping wall thickness and opportunistic visual inspections, are planned.

The inspectors reviewed the program basis document, program and implementing procedures, applicable plant drawings, cathodic protection design baseline document, buried piping risk ranking database, and plant operating experience. Also, the inspectors reviewed a program health report and independent reviews of cathodic protection and soil analyses, and discussed program activities with license renewal and system engineering personnel.

B.2.1.30 ASME Section XI, Subsection IWE

The ASME Section XI, Subsection IWE aging management program is an existing program, credited in the license renewal application, which provides for inspecting the reactor building liner plate and related components for loss of material, loss of pressure retaining bolting preload, cracking due to cyclic loading, loss of sealing, and leakage through seals, gaskets and moisture barriers in accordance with ASME Section XI. Areas of the reactor building adjacent to the moisture barrier and the moisture barrier are subject to augmented examination.

The inspectors reviewed applicable procedures, the latest Inservice Inspection program results and interviewed the Inservice Inspection program manager. The inspectors reviewed a sample of recent corrective action reports from Section IWE examinations.

The inspectors concluded that the Inservice Inspection program was in place, had been implemented, was an ongoing program subject to NRC review, and included the elements identified in the license renewal application. As it is a currently required program subject to periodic review and inspection, the applicant provided adequate guidance to ensure the aging effects will be appropriately assessed and managed.

B.2.1.31 ASME Section XI, Subsection IWL

ASME Section XI, Subsection IWL aging management program is an existing program, and is approved, and is subject to periodic review by the NRC. The program is credited in LRA for managing the aging effects and mechanisms for the systems, components,

and environments. The inspector verified that the ASME Section XI, Subsection IWL program's elements have been evaluated against NUREG-1801. There were no program exceptions. Program would be further enhanced, and the enhancements had been identified. The implementing documents and commitment numbers for this aging management program had been identified. The relevant operating experience has been reviewed and a demonstration of program effectiveness was provided.

Based on the above, the continued implementation of the ASME Section XI, Subsection IWL aging management program will provide reasonable assurance that the aging effects and mechanisms will be adequately managed so that the intended functions of components within the scope of license renewal are maintained during the period of extended operation.

B.2.1.32 ASME Section XI, Subsection IWF

The 10 CFR 50, Appendix J, program is an existing program that conducts tests to assure that: (i) leakage through the reactor containment and systems and components penetrating primary containment shall not exceed allowable leakage rate values as specified in the technical specifications or associated bases, and (ii) periodic surveillance of reactor containment penetrations is performed so that proper maintenance and repairs are made during the service life of the containment, and systems and components that penetrate containment.

The inspection team reviewed documentation, discussed the implementation and program procedures with the responsible system engineer and other supervisory staff, and the prior test results to determine the effectiveness of the program implementation.

The inspectors noted that Primary Containment Leak-Rate Testing Program was performed in accordance with approved procedures which established the requirements for development, implementation, and administration of a leak rate test program. The plant program documents and procedures provided instructions for actual performance of the containment leak rate testing.

Additionally, periodic self-assessments of the 10 CFR Part 50, Appendix J program are performed to identify the areas that need improvement to maintain the quality performance of the program.

Based on the above, the continued implementation of the 10 CFR Part 50, Appendix J aging management program provides reasonable assurance that the aging effects and mechanisms will be adequately managed so that the intended functions of components within the scope of license renewal will be maintained during the period of extended operation.

B.2.1.34 Masonry Walls

The Masonry Wall Program is a part of Structural Monitoring Program.

B.2.1.35 Structures Monitoring Program

The enhanced Structures Monitoring aging management program is an existing program that is consistent with NUREG-1801 aging management program XI.S6, Structures Monitoring with no exceptions, however, enhancements will be incorporated to expand the scope. The Structures Monitoring program was developed and implemented to meet the regulatory requirements of 10 CFR 50.65, Maintenance Rule, USNRC Regulatory Guide 1.160, and NUMARC 93-01, Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants. The program includes masonry walls evaluated in accordance with NRC IEB 80-11, "Masonry Wall Design" and incorporates guidance in NRC Information Notice (IN) 87-67, "Lessons Learned from Regional Inspection of Licensee Actions in Response to IE Bulletin 80-11".

The inspectors reviewed the Aging Management Program description for the Structural Monitoring Program, the Program Evaluation Document for the Structural Monitoring Program, engineering documents, inspection reports, condition reports, corrective action documents, work request documents, site procedures, and related references used to manage the aging effects on the structures. During the inspection, the inspectors conducted a general walkthrough inspection of the site, including the turbine building, reactor containment building, diesel generator building, control room, the intake structure, and other applicable structures, systems, and components related to the Structural Monitoring Program. The inspectors held discussions with applicant's supervisory and technical personnel to verify that areas where effectively examined and inspected for signs of degradation, such as spalling, cracking, leakage through concrete walls, corrosion of steel members, deterioration of structural materials and other aging effects, would been identified and documented. Also, the inspectors verified that the applicant maintains appropriate (photographic and/or written) documentation of these inspections to facilitate effective monitoring and trending of structural deficiencies and degradations.

The Structures Monitoring program has been implemented by procedures that require periodic visual inspections by personnel qualified to monitor structures and components for applicable aging effects, such as those described in the American Concrete Institute Standards (ACI) 349.3R, ACI 201.1R, and Structural Engineering Institute/American Society of Civil Engineers Standard (SEI/ASCE) 11-99. Visual inspections of high strength bolts (greater than or equal to 150 ksi actual yield strength and greater than 1 inch in diameter) will be supplemented with volumetric or surface examinations if highly stressed susceptible bolting materials are found to be in a corrosive environment. Aging effects identified during inspections are evaluated by qualified personnel using criteria derived from industry codes and standards contained in the plant licensing basis and will be enhanced to including additional criteria contained in ACI 349.3R, ACI 318, SEI/ASCE 11-99, and the American Institute of Steel Construction (AISC) specifications, as applicable.

Also, the Structural Monitoring Program further relies on plant procedures that are consistent with guidance in NUREG-1339, and in EPRI guidance (NP-5769, NP-5067, and TR-104213) to ensure structural bolting integrity. The program will be further

enhanced to include periodic sampling and testing of ground water, and the need to assess the impact of any changes in its chemistry on below-grade concrete structures.

Inspectors noted that although the existing Structures Monitoring program procedures monitor the applicable aging effects using subjective criteria which rely on experienced and knowledgeable inspectors and evaluators, the Structures Monitoring program will be enhanced to include applicable objective acceptance criteria from ACI 349.3R.

Based on the above, the continued implementation of the Structural Monitoring Program for aging management will provide reasonable assurance that the aging effects and mechanisms will be adequately managed so that the intended functions of components within the scope of license renewal are maintained during the period of extended operation.

B.2.1.36 RG 1.127, Inspection of Water Control Structures Associated with Nuclear Power Plants

The RG 1.127, Inspections of Water-Control Structures Associated with Nuclear Power Plants program is an existing program which includes the spray pond and pump-house and the yard facility dikes (dikes around the condensate storage tank dikes). Structural components and commodities monitored under the program include reinforced concrete members, steel components (screens, frames and misc. steel), and earthen water-control structures (embankments, dikes).

The inspection team reviewed documents and discussed the program implementation with the system engineer and other supervisory and technical personnel. The team noted that: Although these structures were not classified as dams, and were not subject to the regulatory jurisdiction of the Federal Energy Regulatory Commission (FERC) or the U.S. Army Corps of Engineers, the RG 1.127, Inspection of Water-Control Structures Associated with Nuclear Power Plants aging management program was compatible with the common practices of the FERC and Army Corps of Engineer programs.

The inspectors noted that the program will be further enhanced to incorporate inspection of the structural bolting integrity (loss of material and loosening of the bolts), monitoring of aging effects for increase in porosity and permeability of concrete structures, loss of material for steel components, and the proper functioning of dike drainage systems. Additionally, it will include increased inspection frequency if the extent of the degradation is such that the structure or component may not meet its design basis if allowed to continue uncorrected until the next normally scheduled inspection.

Based on the above, the continued implementation of the Water Control Structures Inspection and Monitoring Program for aging management will provide reasonable assurance that the aging effects and mechanisms will be adequately managed so that the intended functions of components within the scope of license renewal are maintained during the period of extended operation.

B.2.1.38 Insulation Material for Electrical Cables and Connections Not Subject To 10 CFR 50.49 Environmental Qualification Requirements

The Insulation Material for Electrical Cables and Connections Not Subject To 10 CFR 50.49 Environmental Qualification Requirements Program is a new program that will manage the aging effect of reduced insulation resistance as evidenced by embrittlement, discoloration, cracking, melting, swelling, or surface contamination of accessible cables and connections due to exposure to an adverse localized environment. An adverse localized environment is defined as a condition in a limited plant area that is significantly more severe than the specified service environment for the cable or connection.

This program will visually inspect accessible electrical cables and connections installed in adverse localized environments at least once every 10 years. The first inspection for license renewal is to be completed before the period of extended operation.

The inspectors conducted walkdowns to observe cable and connector conditions in potential adverse localized environments. The inspectors reviewed the environmental specifications and cable specifications to evaluate the expected environment for the installed cables compared to the design environment. The inspectors reviewed condition reports and interviewed plant personnel to assess historical and current conditions. The inspectors reviewed the draft program document that will be used for implementing the inspections to verify the program will be able to manage aging effects.

The inspectors noted that the draft procedure MA-AA-723-500, Inspection of Non-EQ Cables and Connections for Managing Adverse Localized Environments, did not require or recommend the use of a camera and relied on electrical maintenance personnel to perform the walkdowns with input from engineering. Exelon informed the inspectors that prior to this inspection, Exelon had contracted with an experienced organization to perform the inspections at Limerick instead of using electrical maintenance personnel. The team reviewed inspections that have been performed by this contractor at other sites and verified that the contractor was experienced and knowledgeable as evidenced by inspections that were thorough, accurate, and well documented.

B.2.1.39 Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits

The Insulation Material for Electrical Cables and Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Used in Instrumentation Circuits Program is a new program that will be used to manage aging of non-EQ cable and connection insulation of the in-scope portions of the Process Radiation Monitoring and Neutron Monitoring Systems. The in-scope process radiation monitoring and neutron monitoring circuits are sensitive instrumentation circuits with high voltage, low-level current signals and are located in areas where the cables and connections could be exposed to adverse localized environments caused by temperature, radiation, or moisture. These adverse localized environments can result in reduced insulation resistance causing increases in leakage currents.

Calibration testing will be performed for the in-scope process radiation monitoring circuits. Direct cable testing will be performed for the in-scope neutron monitoring circuits. These calibration and cable tests will be performed and results will be assessed for reduced insulation resistance prior to the period of extended operation and at least once every 10 years during the period of extended operation.

The inspectors interviewed the responsible program manager to understand the proposed program and instrumentation circuit experience. The inspectors reviewed previous high voltage, low-level current signal cable testing to evaluate the adequacy of the current testing to detect aging effects. The inspectors reviewed issue reports for historical operating experience and draft program guidance for instrumentation cable testing to assess the adequacy of the proposed program to manage aging effects.

B.2.1.40 Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

The Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements (Inaccessible Power Cables) aging management program is described as a new program credited with managing the aging effects of in-scope inaccessible power cables that may be exposed to significant moisture. For this program, a power cable is defined as a cable that carries 400 volts or greater, and significant moisture is defined as periodic exposure to moisture that lasts more than a few days (e.g., cable wetting or submergence in water). The aging effects will be managed by a combination of cable testing and manhole monitoring for water collection, and dewatering.

The cables in this aging management program will be tested using a proven test for detecting insulation degradation, such as dissipation factor (i.e., tan-delta), alternating current (AC) voltage withstand, or other testing methods that are state-of-the-art at the time the test is performed. Exelon's aging management program specified that the cables will be tested at least once every 6 years, with the first tests completed prior to the period of extended operation. Exelon's program further specified that manholes that contain in-scope cables will be periodically inspected for water collection, with corrective actions such as water removal. The frequency of inspection will be adjusted to minimize the potential exposure of in-scope cables to significant moisture. Exelon's program also stated that dewatering devices will be verified functional prior to any known or predicted severe rain event.

The inspectors reviewed an existing cable monitoring program, approved station procedures and supporting documents, application sections A.2.1.40 and B.2.1.40, power cable and manhole aging management review results, and the program basis document to evaluate the effectiveness of the existing program, with planned enhancements, to manage the effects of the identified aging mechanisms. The inspectors reviewed applicant responses to requests for additional information.

The inspectors noted that the existing program had not been fully developed, and was not implemented at the time when Exelon's license renewal application was prepared and submitted. Therefore, Exelon's application referred to the cable program as new, rather than as an existing program that needed enhancements.

The inspectors reviewed in-progress modifications to add automatic dewatering systems to in-scope manholes that contained safety-related power cables, and to add water level monitoring instruments with remote alarm and indication to in-scope manholes that contained non-safety related power cables. In addition, the inspectors interviewed Exelon personnel regarding recent and historical manhole inspection results. The inspectors concluded that the modifications, if completed as currently planned, could result in an adequate method to keep the cables dry. The inspectors also interviewed engineering and maintenance personnel regarding corrective actions recently taken or planned to improve and formalize (e.g., enhance) the existing cable monitoring program. The inspectors concluded that the planned actions had sufficient detail and guidance to ensure that the Inaccessible Power Cables aging management program would be reasonably implemented.

The inspectors verified that Exelon had performed adequate historic reviews of plant specific and industry experience to determine aging effects. The inspectors noted that there were no exceptions to the recommendations of NUREG-1801, Rev. 2, XI.E3, "Inaccessible Power Cables Not Subject to 10 CFR 50.49 Environmental Qualification Requirements."

The inspectors concluded Exelon had performed adequate evaluations, including reviews of industry experience and plant history, to determine aging effects. In program level documents, Exelon provided adequate guidance to ensure aging effects will be appropriately identified and addressed.

B.2.1.41 Metal Enclosed Bus

The Metal Enclosed Bus aging management program is a new program that will manage the following aging effects of in-scope metal enclosed buses: degradation of the enclosure assemblies due to cracks, corrosion, foreign debris, excessive dust buildup, and water intrusion; reduced bus insulation resistance due to embrittlement, cracking, chipping, melting, discoloration, swelling, or surface contamination; degradation of the internal bus supports due to loss of structural integrity or cracking; degradation of enclosure assembly elastomers due to surface cracking, crazing, scuffing, dimensional change, shrinkage, discoloration, hardening, and loss of strength; and loosening of bolted connections due to thermal cycling and ohmic heating.

This new program will be implemented prior to entering the period of extended operation and at least once every 10 years, thereafter. The program will consist of visual inspections of a sample of: the internal portions of the bus enclosures, bus insulation, internal bus supports, and enclosure assembly elastomers. The program will also include thermography inspections of a sample of accessible metal enclosed bus bolted connections.

The inspectors reviewed previous work orders for inspection and cleaning activities for metal enclosed buses to assess the adequacy of the current maintenance program for managing aging effects. The inspectors interviewed the associated system engineer, program manager, and thermography expert to verify the adequacy of the proposed program to manage the aging effects. The inspectors reviewed condition reports to assess the historical and current condition of the metal enclosed buses. The inspectors conducted a walkdown of all accessible portions of the metal enclosed bus enclosures to evaluate the exterior condition of the bus enclosures, the operating environment, and the feasibility of the proposed program.

The inspectors reviewed the draft revision to the recurring work order that will be used for the metal enclosed bus visual inspections. The work order referenced M-092-002, 4KV Switchgear Maintenance, for the inspection requirements. The inspectors noted that the inspection criteria included in the license renewal application were not in the draft revision to M-092-002; specifically, inspecting the metal enclosed bus for cracking and corrosion. Exelon responded by initiating an action item in LRCR REGION-4 to include all of the inspection criteria in M-092-002. The inspectors also noted a potential point of confusion with using a switchgear maintenance procedure to perform metal enclosed bus inspections. Exelon responded by initiating an action item in LRCR REGION-4 to include specific step numbers that are required from the referenced procedure. The inspectors also noted that the inspection scope for conducting visual inspections in NUREG-1801 and the Limerick License Renewal Application both state, "The internal portions of the bus enclosure assemblies will be inspected . . ." Exelon initiated an action item in LRCR REGION-4 to clarify that the inspections will be only for all "accessible" portions of the metal enclosed bus.

B.2.1.42 Fuse Holders

The Fuse Holders aging management program is a new program that will manage the aging effects of the metallic portions of fuse holders. Stressors managed by this aging management program include frequent manipulation, vibration, chemical contamination, corrosion, oxidation, ohmic heating, thermal cycling, and electrical transients.

The program consists of testing the fuse holders, by a proven test methodology, prior to the period of extended operation, and at least once every 10 years. Visual inspection is not part of this program. The specific type of test to be performed will be determined prior to the initial test and will be a proven test of detecting deterioration of the metallic clamps. Testing may include thermography, contact resistance testing, or other appropriate testing methods.

The inspectors interviewed the associated program manager to verify the adequacy of the proposed program to manage the aging effects. The inspectors reviewed condition reports to assess the historical and current condition of the in-scope fuse holders. The inspectors reviewed photographs and drawings of the fuse holders to evaluate the exterior condition of the bus enclosures, the operating environment, and the feasibility of the proposed program.

B.2.1.43 Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements

The Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements program is a new program. The program will perform a one-time inspection to ensure that either increased resistance of connections is not occurring or that the existing preventive maintenance program is effective such that a periodic inspection program is not required.

A representative sample of non-EQ electrical cable connections will be selected for one-time testing considering application (medium and low voltage), circuit loading (high loading), and location (high temperature, high humidity and vibration). The sample tested will be 20 percent of the population with a maximum sample size of 25 connections. The technical basis for the sample selected is to be documented. The specific type of test performed will be a proven test for detecting increased resistance of connections, such as thermography, contact resistance measurement, or another appropriate test. The one-time tests will be completed prior to the period of extended operation.

The inspectors reviewed LG-SSBD-E6, Electrical Cable Connections Not Subject to 10 CFR 50.49 Environmental Qualification Requirements Sample Basis Document, which described the sample selection. The inspectors determined that LS-SSBD-E6 was in accordance with the Limerick License Renewal Application and NUREG-1801. Nevertheless, the inspectors questioned what the population in LG-SSBD-E6 represented, how the samples would be selected, and whether the maximum sample size of 25 connections was appropriate to provide a representative sample of the site. Exelon initiated an action item in LRCR REGION-6 to improve the implementing work order to clarify the sample selection criteria to ensure that the sample selection is representative of the connections throughout the plant.

b. Findings

The inspection team concluded screening and scoping of non-safety related systems, structures, and components, was implemented as required in 10 CFR 54.4(a)(2), and the aging management portion of the license renewal activities were conducted as described in the License Renewal Application. The inspection team concluded the documentation supporting the application was in an auditable and retrievable form. The inspection team concluded the applicant adequately considered operational experience in formulating their proposed aging management programs.

This inspection verified, for selected aging management programs, the acceptability of the existing, modified, or proposed aging management programs and determined that Exelon demonstrated the capability to manage the effects of aging during the period of extended operation. The inspection results support a conclusion the proposed activities will reasonably manage the effects of aging, in the systems, structures, and components identified in the application, for the extended period of operation.

4OA6 Meetings, including Exit

On June 21, 2012, the inspectors presented the inspection results to Mr. F. Kearney, Site Vice President, and other members of the Limerick staff. The inspectors verified that no proprietary information was retained by the inspectors or documented in this report.

ATTACHMENT: SUPPLEMENTARY INFORMATION

ATTACHMENT

SUPPLEMENTARY INFORMATION

KEY POINTS OF CONTACT

Licensee Personnel

F. Kearney, Site Vice President
P. Gardner, Plant Manager
C. Rich, Director of Operations
D. Doran, Director of Engineering
R. Kreider, Director of Maintenance
P. Colgan, Director of Work Management
C. Gerdes, Security Manager
R. Dickinson, Director of Training
K. Kemper, Manager Nuclear Oversight
D. Merchant, Radiation Protection Manager
J. Hunter, Manager, Regulatory Assurance
M. Gillin, Sr. Manager Engineering Systems
L. Harding, Regulatory Assurance Engineer
R. Rhode, Licensed Operator Requalification Training Supervisor
D. Wahl, Effluent REMP Engineer
R. Higgins, Environmental Engineer
L. Konen, Chemistry Technician
B. Lance, Chemistry Manager
A. Varghese, Site Engineer, Radiation Monitoring
A. Lambert, Design Engineer
L. Parlatore, Radiation Protection Technician
A. Rocco, System Engineer
D. Ryan, Senior Chemist
J. Duskin, Supervisor, Radiation Protection Instrumentation
R. Goskins, Instrument Technician
P. Imm, Radiological Engineering Supervisor
J. Ristetler, Supervisor – Radiation Protection
S. Sweisford, Instrument Technician
H. Miller, HP Shipping
C. Smith, Chemistry
G. Budock, ISI Program Owner
T. Kirkpatrick, Radiation Protection Supervisor
J. Bruno, Radiological Engineer
J. Commisky, ALARA Specialist
N. Harmon, Senior technical Specialist
R. Nealis, Senior Chemist
C. Conroy, Environmental Chemist

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